ASME MFC-12M–2006

Measurement of Fluid Flow in Closed Conduits Using Multiport Averaging Pitot Primary Elements

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AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

Date of Issuance: October 9, 2006

This Standard will be revised when the society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at http://www.asme.org/codes/ as they are issued.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

Multiport averaging pitot primary elements cover a family of head-class devices that make use of the Bernoulli principal to measure the flow of liquids and gases. This Standard tries to clarify differences between the construction and operation of these devices and other head-class devices, such as orifice meters, Venturi meters, and nozzles.

Due to differences in the design of multiport averaging pitot primary elements, this Standard cannot address detailed performance characteristics in specific applications. It does cover issues that are common to such devices.

Suggestions for improvements to this Standard are encouraged and should be sent to: Secretary, ASME MFC Committee, the American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ASME MFC-12M–2006 was approved by the American National Standard Institute on March 21, 2006.

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Measurement of Fluid Flow in Closed Conduits

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending committee meetings. Correspondence should be addressed to:

Secretary, MFC Standards Committee
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Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Interpretations. Upon request, the MFC Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the MFC Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

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MEASUREMENT OF FLUID FLOW IN CLOSED CONDUITS USING MULTIPORT AVERAGING PITOT PRIMARY ELEMENTS

1 SCOPE

This Standard, provides information on the use of multiport averaging Pitot head-type devices used to measure liquids and gases. The Standard applies when the conduits are full and the flow

(a) has a fully developed profile

(b) remains subsonic throughout the measurement section

(c) is steady or varies only slowly with time

(d) is considered single-phase

A differential pressure transmitter or other pressure measuring device, known as a secondary element, must be used with a multiport averaging Pitot primary element to produce a flow rate measurement.

Although multiport averaging Pitot primary elements are sometimes used in noncircular conduits, such applications are beyond the scope of this Standard.

2 TERMS AND DEFINITIONS

The terminology and symbols (Table 1) used in this Standard are in accordance with ASME MFC-1M. Some items from ASME MFC-1M are listed in para. 2.2.1 for easier reference.

Terminology not defined in ASME MFC-1M, but used in this Standard, are defined in para. 2.2.2.

2.1 Symbols

See Table 1.

2.2 Definitions

2.2.1 Definitions Found in ASME MFC-1M

cavitation: the implosion of vapor bubbles formed after flashing when the local pressure rises above the vapor pressure of the liquid. See also *flashing.*

differential pressure device: device inserted in a pipe to create a pressure differential whose measurement, together with a knowledge of the fluid conditions and of the geometry of the device and the pipe, enables the flow rate to be calculated.

flashing: the formation of vapor bubbles in a liquid when the local pressure falls to or below the vapor pressure of the liquid, often due to local lowering of pressure because of an increase in the liquid velocity. See also *cavitation.*

primary device (of a differential pressure device): differential pressure device with its pressure tappings.

rangeability: flowmeter rangeability is the ratio of the maximum to minimum flowrates or Reynolds number in the range over which the primary element meets a specified uncertainty (accuracy).

reproducibility: the closeness of agreement between results obtained when the conditions of measurement differ; for example, with respect to different test apparatus, operators, facilities, time intervals, etc.

Reynolds number: a dimensionless parameter expressing the ratio between inertia and viscous forces. It is given by the formula

$$Re = \frac{Vl}{v} \tag{1}$$

where

V = average spatial fluid velocity
l = characteristic dimension of the system in which the flow occurs
v = kinematic viscosity of the fluid

NOTE: When specifying a Reynolds number, one should indicate the characteristic dimension on which it has been based (e.g., diameter of the pipe or width of the multiport averaging Pitot primary element).

total pressure (or total head): also known as stagnation pressure; sum of the static pressure and the dynamic pressure. It characterizes the state of the fluid when its kinetic energy is completely transformed into potential energy.

2.2.2 Definitions for MFC-12M

APT or averaging Pitot tube: common abbreviation for multiport averaging Pitot primary element.